

The Specification has been amended to include information previously incorporated by reference. More specifically, page 12, line 25-28 incorporated by reference commonly owned, copending U.S. Patent Application No. 09/619,848. The added text is a direct copy of page 10, line 29 to page 11, line 3 of this commonly owned, copending Patent Application. No new matter has been added.

Rejections Under 35 U.S.C. § 102(b) and § 103(a)

Claims 1-32 are rejected under 35 U.S.C. §102(b), or in the alternative for claim 30 under 35 U.S.C. §103(a), as being unpatentable over Pelrine et al. "Electrostriction of Polymer Dielectrics with Compliant Electrodes and a Means of Actuation" ("Pelrine article"). Applicants respectfully traverse.

Independent claims 1, 10, 15, and 33 have been amended to clarify the pre-strain polymers of the present invention. The claims all now recite an electroactive polymer is elastically pre-strained by a factor in the range of about 1.5 times to 50 times the original area. Support for this amendment is provided in the Specification on page 11, lines 31 to page 13, line 10, and in the amendment to the Specification described above, for example. The Pelrine article does not mention elastic pre-strain as recited, and Applicants submit that independent claims 1, 10, 15, and 33 are patentably distinct from the Pelrine article for at least this reasons.

Independent claim 28 recites a common electrode that is shared by two active areas. The Pelrine article does not disclose such a limitation.

Independent claim 37 recites "providing a change in electric field to the at least two first active area electrodes" and "mechanically deflecting the first portion after the change in electric field has been provided, wherein the mechanical deflection after the change in electric field has been provided increases the electrical field between the at least two first active area electrodes" The Pelrine article does not disclose such a limitation.

For at least these reasons, Applicants submit that all independent claims are patentably distinct from the Pelrine article.

Claims 2-9, 11-14, 16-27 and 29-31 each depend either directly from independent claims 1, 10, 15, 28 and 32, respectively, and are therefore respectfully submitted to be patentable over the art of record for at least the reasons set forth above with respect to the independent claims. Further, the dependent claims recite additional elements which when taken in the context of the claimed invention further patentably distinguish the art of record.

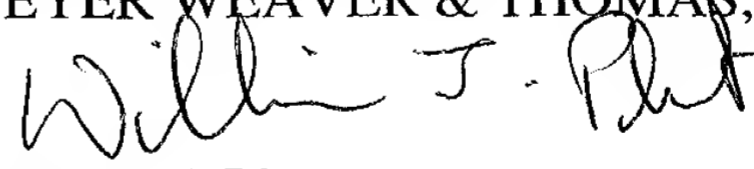
For example, dependent claim 4 recites "wherein the at least two first active area electrodes and the at least two second active area electrodes are arranged radially around a central point". It is respectfully submitted that the Pelrine article does not teach such a limitation.

For at least these reasons, withdrawal of the rejections under 35 U.S.C. § 102(b) and under 35 U.S.C. § 103(a) are respectfully requested.

Conclusion

In view of the foregoing, Applicant believes that all pending claims are allowable and respectfully requests a Notice of Allowance from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the number set out below. If any fees are due in connection with the filing of this paper, the Commissioner is authorized to charge such fees to Deposit Account 50-0388 (Order No. SRI1P028).

Respectfully submitted,
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Limited Recognition under 37 C.F.R. § 10.9(b)

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

Please INSERT the following paragraph beginning on page 12, line 27:

--The quantity of pre-strain for a polymer may be based on the electroactive polymer and the desired performance of the polymer in an actuator or application. For some polymers of the present invention, pre-strain in one or more directions may range from -100 percent to 600 percent. By way of example, for a VHB acrylic elastomer having isotropic pre-strain, pre-strains of at least about 100 percent, and preferably between about 200-400 percent, may be used in each direction. In one embodiment, the polymer is pre-strained by a factor in the range of about 1.5 times to 50 times the original area. For an anisotropic acrylic pre-strained to enhance actuation in a compliant direction, pre-strains between about 400-500 percent may be used in the stiffened direction and pre-strains between about 20-200 percent may be used in the compliant direction. In some cases, pre-strain may be added in one direction such that a negative pre-strain occurs in another direction, e.g. 600 percent in one direction coupled with -100 percent in an orthogonal direction. In these cases, the net change in area due to the pre-strain is typically positive.--

In the Claims:

Please AMEND the claims as follows.

1. (Twice Amended) A transducer for converting between electrical energy and mechanical energy, the transducer comprising an electroactive polymer having a plurality of active areas, the plurality of active areas comprising:

a first active area having at least two first active area electrodes and a first portion of the electroactive polymer arranged in a manner which causes the first portion to deflect in response to a change in electric field provided by the at least two first active area electrodes and/or arranged in a manner which causes a change in electric field in response to deflection of the first portion; and

a second active area having at least two second active area electrodes and a second portion of the electroactive polymer arranged in a manner which causes the second portion to deflect in response to a change in electric field provided by the at least two second active area electrodes and/or arranged in a manner which causes a change in electric field in response to deflection of the second portion,

wherein the electroactive polymer is elastically pre-strained by a factor in the range of about 1.5 times to 50 times the original area.

10. (Twice Amended) A device for converting between electrical energy and mechanical energy, the device comprising:

an electroactive polymer having a plurality of active areas, the plurality of active areas comprising:

a first active area having at least two first active area electrodes and a first portion of the electroactive polymer arranged in a manner which causes the first portion to deflect in response to a change in electric field provided by the at least two first active area electrodes and/or arranged in a manner which causes a change in electric field in response to deflection of the first portion,

a second active area having at least two second active area electrodes and a second portion of the electroactive polymer arranged in a manner which causes the second portion to deflect in response to a change in electric field provided by the at least two second active area electrodes and/or arranged in a manner which causes a change in electric field in response to deflection of the second portion; and

a substantially rigid member coupled to a third portion of the electroactive polymer,

wherein the electroactive polymer is elastically pre-strained by a factor in the range of about 1.5 times to 50 times the original area.

15. (Twice Amended) A method for using an electroactive polymer comprising a first active area and a second active area, the first active area having at least two first active area electrodes and a first portion of the electroactive polymer, the second active area having at least two second active area electrodes and a second portion of the electroactive polymer, the method comprising:

prestraining the electroactive polymer by a factor in the range of about 1.5 times to 50 times the original area;

providing a change in electric field to the at least two first active area electrodes;
and

providing a change in electric field to the at least two second active area electrodes.

33. (Twice Amended) A device for converting between electrical energy and mechanical energy, the device comprising:

an [elastically prestrained] electroactive polymer prestrained by a factor in the range of about 1.5 times to 50 times the original area and having a plurality of active areas, the plurality of active areas comprising:

a first active area having at least two first active area electrodes and a first portion of the electroactive polymer arranged in a manner which causes the first portion to deflect in response to a change in electric field provided by the at least two first active area electrodes and/or arranged in a manner which causes a change in electric field in response to deflection of the first portion,

a second active area having at least two second active area electrodes and a second portion of the electroactive polymer arranged in a manner which causes the second portion to deflect in response to a change in electric field provided by the at least two second active area electrodes and/or arranged in a manner which causes a change in electric field in response to deflection of the second portion;

a substantially rigid member having a first segment and a second segment, the first segment coupled to a third portion of the electroactive polymer, the second segment

capable of motion assisted by deflection of the first portion of the polymer and/or capable of motion that causes a change in electric field in the first portion of the polymer; and

a frame coupled to a fourth portion of the polymer.